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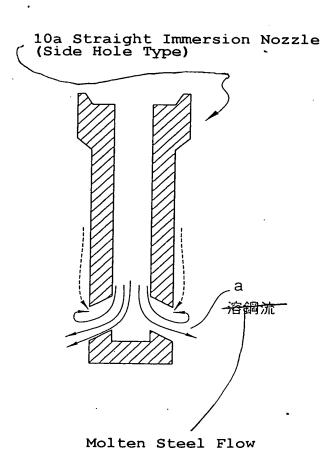
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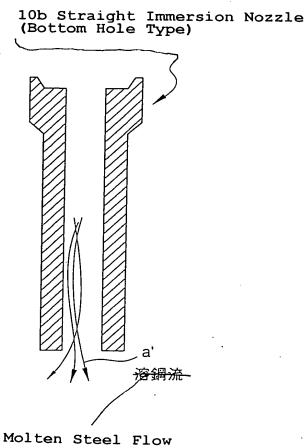
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Fig. 1

(A)

(B)





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·FIG. 2

		Exa	mple
•		1	2
	Diameter D (mm) of Inner Hole Portion	80	90
		Elliptic	Spherical
Protrusions	Approximate Shape		-
	Maximum Height H (mm)	8	10
	Maximum Length L (mm) of Base Portion	32	27
	Number of disposed Protrusions	54	70
	L/H	4.0	2.7
	πD/L	7.9	10.5
Surface Area	a Increasing Rate (%)	116	114
,	Degree of Drift	No	No
Water Model	Minus Flow (Presence or Absence of Suction Flow)	Absent	Absent
	Strength of Protrusions	OK	OK
Actual Machine	Deposition (mm) of Alumina on Inner Pipe	1	0
Tota	al Evaluation	0	0

777									
	Example								
3	4	5	6	. 7	8				
80	80	80	60	80	80				
Spherica	Spherica	Conical	Trapezoi	Trapezoi	Trapezoi				
1	1	Conficat	. d	d	đ				
_	_								
2	5	10	5	15	10				
10	15	22	58	31	21				
60	50	90	30	230	250				
5.0	3.0	2.2	11.6	2.1	2.1				
25.1	16.7	11.4	3.2	8.1	12.0				
102	106	115	119	345	240				
No	No	No	No	No	No				
Absent	Absent	Absent	Absent	Absent	Absent				
OK	OK	OK	OK	OK	OK				
3	1	1	0	3	0				
0	0	0	0	0	0				

· FIG. 3

		Comparative E	xample
		1	2
	Diameter D (mm) of Inner Hole Portion	80	90
		Stepped	Straight
Protrusions	Approximate Shape		None
Protrusions	Maximum Height H (mm)	5	
	Maximum Length L (mm)	(circumferential	_
	of Base Portion	length: 251)	_
	Number of disposed Protrusions	1	0
	L/H	(50.2)	
		1.0	-
Surface Area	πD/L Increasing Rate (%)	97	100
Surface Area	Degree of Drift	Middle	
	Minus Flow (Presence	Middle	Large
Water Model	or Absence of Suction Flow)	Present	Present
2	Strength of	OK	_
Actual	Protrusions		
Machine	Deposition (mm) of Alumina on Inner Pipe	8	12
Tota	l Evaluation	×	×

		Comparativ	re Example		4
3	4	5	6	7	8
80	80	80	60	80	80
Spherica l	Conical	Spherica 1	Spherica 1	Elliptic	Trapezoi d
		_	_		
10	5	1	5	2	12
8	3	10	10	3	24
50	50	50	50	80	350
0.8	0.6	10.0	2.0	1.5	2.0
31.4	83.7	25.1	25.1	83.7	10.5
115	103	102	104	101	364
No	No	Large	Small	Middle	Small
Absent	Absent	Present	Absent	Present	Present
NG	NG	OK	NG	NG	OK
6	6	10	5	6	7
×	×	×	×	×	×

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30 Straight Immersion Nozzle 32 Inner Hole Portion (Molten Steel Flow Hole Portion) - 31 Body Portion α 34 Spherical Protrusion Portion 33 Powder Line Portion

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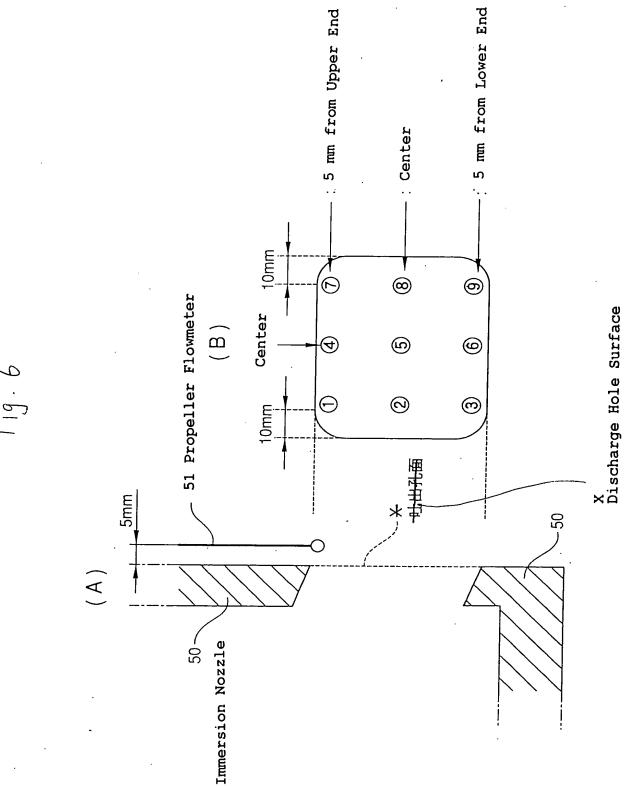


FIG. 7

(A)

[Immersion Nozzle according to Comparative Example 1]

[Throughput: equivalent to 3 steel T/min]

	Left			Right		
	Rear	Center	Front	Front	Center	Rear
Upper	39	3	-1	8	49	51
Center	13	16	8	41	11	3
Lower	-2	36	38	58	-9	9

[Throughput: equivalent to 5 steel T/min]

	Left			Right		
	Rear	Center	Front	Front	Center	Rear
Upper	88	22	-6	20	83	103
Center	14	31	12	70	22	7
Lower	-18	60	68	. 96	-10	-1

[Throughput: equivalent to 7 steel T/min]

	Left			Right		
	Rear	Center	Front	Front	Center	Rear
Upper	102	40	0	22	97	106
Center	27	27	32	78	38	21
Lower	6	95	75	98	19	10

Flow Rate	手前 中央 奥
0>	/±(· · ·)
0-50	
50-100	
100<	
	Front Center Rear Upper
	Center
	Lower

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(B)

[Immersion Nozzle according to Example 1]

	Left			Right		
	Rear	Center	Front	Front	Center	Rear
Upper	3	13	18	23	20	12
Center	18	16	18	25	26	27
Lower	41	43	2	25	36	22

	Left			Right		
	Rear	Center	Front	Front	Center	Rear
Upper	41	27	16	24	39	55
Center	11	21	36	39	32	22
Lower	15	77	41	62	52	12

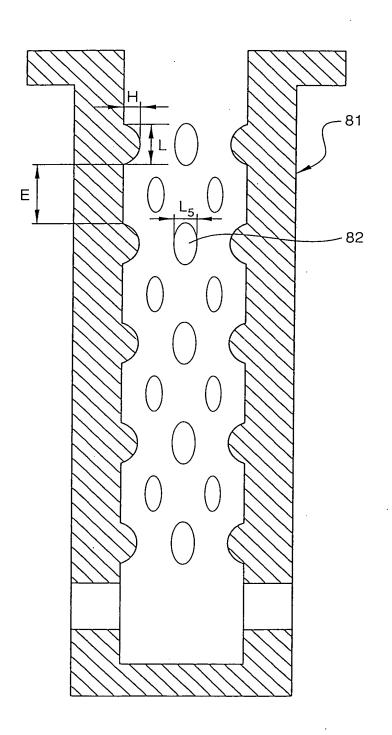
	Left			Right		
	Rear	Center	Front	Front	Center	Rear
Upper	122	59	26	37	62	98
Center	32	32	38	63	60	42
Lower	55	66	62	98	43	29

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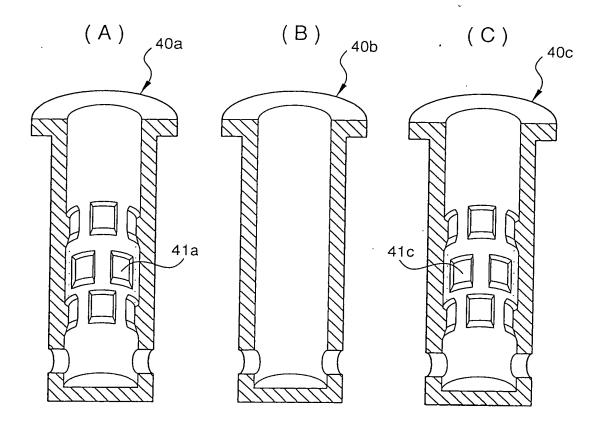
Fig. 8

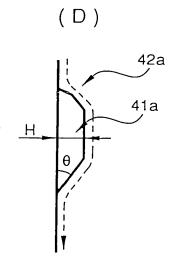


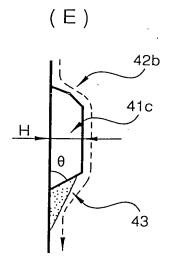
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Fig. 9







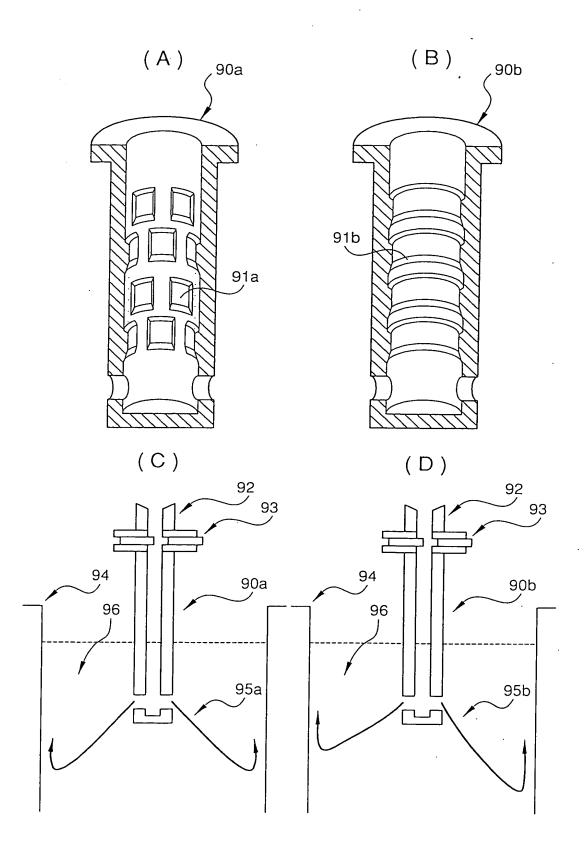
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Fig. 10



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FIG. 11

		Example						
	12	13	14	15	16			
Sectional Shape of Protrusion Portion	θ=38°	θ=35°	θ=13°	θ = 27°	θ=58°			
Presence or Absence of Stagnation just under Protrusion	Absent	Absent	Absent	Absent	Absent			
Straighten ing Effect	Good	Good	Good	Good	Good			

	Comparative Example				
	14	15	16	17	18
Sectional Shape of Protrusion Portion	θ=72°	θ=77°	θ=70°	θ=90°	θ=90°
Presence or Absence of Stagnation just under Protrusion	Present	Present	Present	Present	Present
Straighten ing Effect	Bad	Bad	Bad	Bad	Bad

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Fig. 12

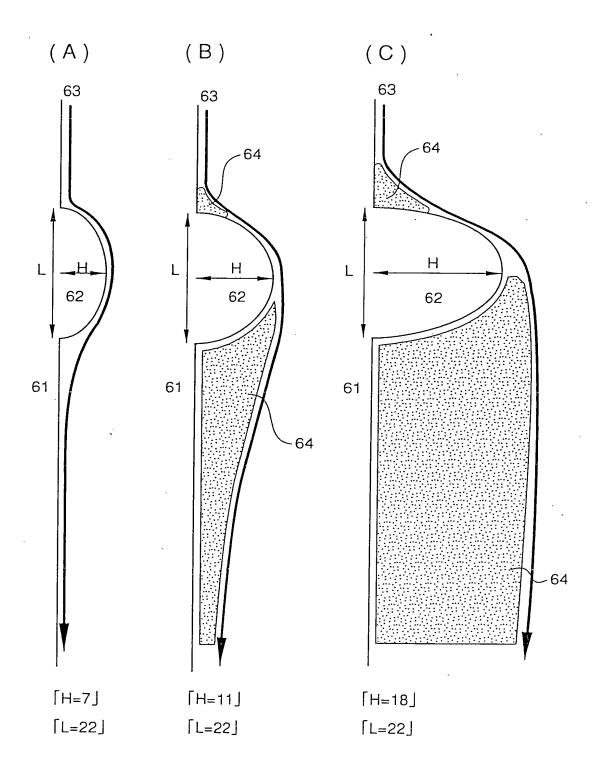
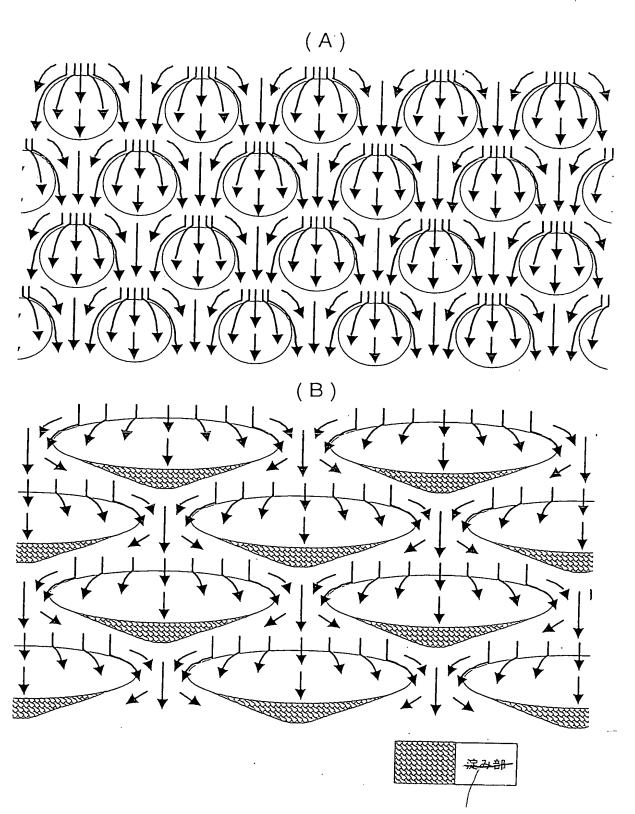
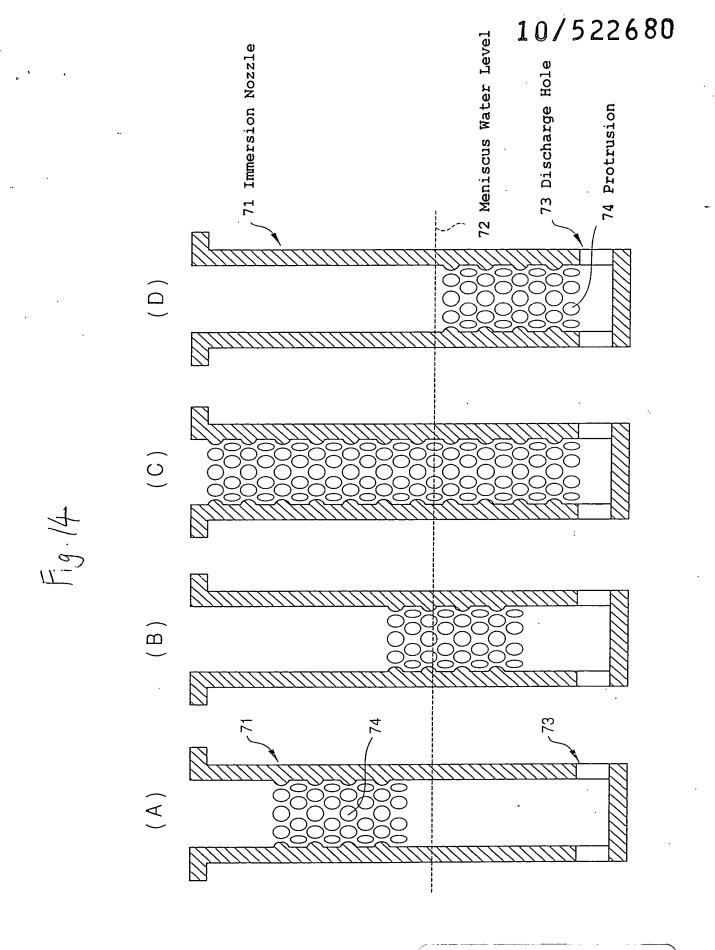


Fig. 13

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Stagnation Portion



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